relatively high barometric pressure over eastern and southeastern Alaska, as was observed during much of the month of March, 1924, is commonly associated with low barometric pressure over that part of the United States west of the Rocky Mountains, in which region of low barometric pressure, many of the cyclones of the month were first observed.

WASHINGTON FORECAST DISTRICT

Storm warnings were required at frequent intervals for the Atlantic and Gulf coasts. The first display was on the 8th, when at 9 a. m. northwest storm warnings were ordered for the Atlantic coast from Delaware Breakwater to Portland, Me., when a disturbance of increasing intensity was central in the vicinity of Nova Scotia. This was followed by a display of storm warnings on the east Gulf Coast on the morning of the 9th; and on the 10th the display of storm warnings was extended to the entire Atlantic coast north of Juniper Inlet, Fla. This disturbance developed into what may be regarded as the severest and most prolonged disturbance of the month. On the morning of the 10th when the primary storm center was over the Ohio Valley there were evidences of the formation of another disturbance off the Carolina coast. As ordinarily happens when this type of pressure distribution occurs the primary cyclone disappears while the secondary increases greatly in intensity. This happened in this case, so that within 24 hours the primary cyclone disappeared while the one off the Carolina coast developed, moved northward and gained great intensity. By the morning of the 11th the pressure had fallen to 28.82 inches at Cape Henry, Va., and gales were general along practically the entire Atlantic seaboard. On the evening of the 10th when it was apparent that this condition would take place, the ordinary storm warnings were displaced by "whole gale" warnings on the Atlantic coast between Delaware Breakwater and Portland, Me. It was necessary to continue warnings on the Atlantic coast as far south as Savannah, Ga., into the 13th.

This great storm had scarcely passed off the coast, when it became necessary on the 13th to display storm warnings on the east Gulf and South Atlantic coasts, in connection with a disturbance that passed rapidly eastward from near the mouth of the Rio Grande to the South Atlantic coast, attended by strong winds and general rains and snows in the Southern States. During the 16th and 17th small-craft warnings remained displayed at and north of the Virginia Capes, while during the period, the 19th to 21st, storm warnings were displayed on one or more of these days for the entire Atlantic and east Gulf coasts. The disturbance in question was central the morning of the 19th near the mouth of the Rio Grande. It gained intensity very rapidly and started to move east-northeastward. On the morning of the 20th the primary center was over western Tennessee, while at the same time there were unmistakable indications of the formation of a secondary cyclone center over southern Georgia. The primary center over western Tennessee advanced northeastward and disappeared over the upper Ohio Valley, while the secondary over southern Georgia gained markedly in intensity and moved north and became a storm of marked severity by the time its center passed east-northeastward off the Virginia Capes on the 20th. Another disturbance central the morning of the 26th over the upper Ohio Valley made necessary the display of storm warnings at that time on the Atlantic coast at and north of the Virginia Capes, and on the 28th when a disturbance of pronounced character was central over Kansas, storm warnings were displayed on the east Gulf coast and on the 29th when the center of this disturbance was over southern Iowa, storm warnings were displayed on the Atlantic coast at and north of Jacksonville, Fla.

Frost warnings were required during the month on a number of days for the Southern States, and on the 29th cold wave warnings were ordered for the Ohio Valley and Tennessee.

CHICAGO FORECAST DISTRICT

For a winter month, March, 1924, in the Chicago Forecast District was comparatively quiet, from the point of view of the forecaster. Only one severe storm affected the district, but that indeed was a notable one; further reference to it will appear later in this report. Sudden and marked temperature fluctuations were largely absent during the month, and as a corollary but few cold waves occurred. The only cold wave warnings issued were those on the 6th for northeastern Minnesota, and on the 29th for northwestern Missouri and southeastern Iowa. The former was not verified, although the antecedent conditions appeared to have been almost ideal. Probably the explanation lies in the fact that the cyclonic area centered over western Lake Superior on the morning of the 6th was sluggish in its further movement. Twenty-four hours later the center had advanced only to northern lower Michigan. The cold wave warnings of the 29th were verified, but as developments showed, the warnings should have embraced in their scope northern Illinois and southern lower Michigan, even though a technical verification was not attained over all these two areas.

Warnings, advisory as to expected storm conditions on Lake Michigan, were issued on the 3d, 20th, 28th, and 29th, the last mentioned being a continuation of the warning of the previous date. On the night of the 3d a disturbance of increasing energy and with a central pressure of 29.36 inches was over northeastern Kansas, advancing toward the Great Lakes. Accordingly, advices were issued to the effect that strong shifting winds and moderate gales might be expected over Lake Michigan. Although the disturbance maintained its low pressure as it crossed the Lakes, no winds of storm force were registered. The next advisory warning was issued on the 20th, when a disturbance of rather marked character was central in western Tennessee with a north-northeastward movement. On the afternoon of the date in question a maximum velocity of 36 miles an hour occurred at Chicago, and 31 miles at Milwaukee.

The most important storm of the month, and in fact one of the most severe storms of record in certain portions of the district, prevailed on the 28th, 29th, and 30th. It appears to have originated, or at any rate it developed, over the northern Rocky Mountain region. By the morning of the 28th the center was in eastern Colorado with barometer readings of 29.24 inches at Denver and Pueblo. Thence a north-northeast course was taken, which carried the center across the extreme southern end of the upper Lake region and later down the St. Lawrence Valley. By the night of the 28th the storm was showing marked intensity, and accordingly a warning, in which vessel masters were advised to exercise caution, was issued for Lake Michigan. During the passage of the disturbance from Kansas to the upper Lake region sharply contrasted weather conditions prevailed on the two sides (northern and southern) of the storm. Over the former area a great snowstorm occurred, accompanied

by northeast gales. In the Twin Cities (St. Paul and Minneapolis) the storm was especially intense. On the southern side of the disturbance severe thunderstorms were a feature, accompanied by southwest to northwest gales. In portions of Kansas and Missouri some tornadoes occurred. An interesting feature of the storm was a deposit of "red mud" over a wide area, including at least eastern Iowa, southern Wisconsin, and northern Illinois.

Other special warnings issued during the month were those for stock interests in South Dakota, Nebraska, Kansas, and Wyoming on the 15th, and the western portions of Kansas and Nebraska on the 28th; also a heavy-snow warning for northern Missouri on the 16th.

Frost and cold-wave warnings for the benefit of the strawberry interests in southwestern Missouri were begun on the 15th, this being an annual feature of the work of this office. The season lasts until April 20.—*C. A. Donnel.*

NEW ORLEANS FORECAST DISTRICT

A cold wave of considerable severity overspread the greater portion of the district, extending to the coast, on the 9th and 10th, for which timely warnings were issued. Warnings which were verified were issued on the 13th for a cold wave on the Texas coast. Warnings were issued on the 16th, 17th, and 30th for cold waves which occurred over limited areas in the northwest portion of the district. Conditions were threatening on the 31st, and cold-wave warnings were ordered for the Texas coast; a decided fall in temperature occurred, but the lowest temperature was 42° to 46°. No cold waves occurred without warnings and no warnings were issued which were not justified.

Storm warnings were displayed on the Texas coast on the 9th, 13th, 17th, 22d and 28th, and on the Louisiana coast on the 13th and 19th. Storm winds occurred with each display on the Texas coast, but at New Orleans the velocities did not quite reach the requirement for verification. Small-craft warnings were issued for portions of the West Gulf coast on the 3d, 8th, 9th, 12th, 13th, 15th, 16th, 19th, 22d, 28th, and 31st, all of which were justified. No storms occurred without warnings and no warnings, except as needed, were issued.

Special wind warnings were issued on the morning of the 28th and distributed over the States in the district as follows: Louisiana, increasing southerly winds; Arkansas, thunderstorms, fresh to strong southerly winds, probably gales, this afternoon and tonight; Oklahoma, strong southerly winds this afternoon, shifting to northwest early Saturday; east Texas, fresh to strong southerly winds this afternoon and to-night, shifting to westerly Saturday. Damaging winds occurred in Arkansas, Oklahoma and northern Texas.—*I. M. Cline.*

DENVER FORECAST DISTRICT

The month was especially cold and stormy throughout, with a succession of LOWS advancing across the district from the Pacific coast or from the middle and southern portions of the Rocky Mountain Plateau.

On the morning of the 2d, when a disturbance of marked intensity was central over Nevada, livestock warnings were issued for western Colorado, northern New Mexico, northern Arizona, and Utah, snow and much colder weather, with strong shifting winds, having been forecast for that territory. Light snow, with considerably lower temperatures and fresh to strong shifting winds, attended or followed the passage of the storm eastward.

Livestock warnings were also issued on the morning of the 8th for southwestern Colorado and northern New Mexico, when another disturbance was central over that region. Light to moderately heavy snow, attended by strong shifting winds, occurred during the 8th in the territory designated, followed by a sharp fall in temperature that amounted to a cold wave at Santa Fe and Durango on the morning of the 9th.

On the morning of the 15th, when a disturbance of unusual intensity was central over western Colorado, with a pressure of 29.34 inches at Grand Junction and rapidly increasing pressures to the northward and northwestward, warnings of a moderate cold wave were issued for western Colorado, northeastern Arizona and southern Utah "to-night" and for northern New Mexico "to-night and Sunday." The warning was extended to southern New Mexico on the evening of the same date. The temperatures in northeastern Arizona and southwestern Utah were 20° lower on the evening of the 15th than at the same time on the 14th, with a minimum of 14° at Modena and of 18° at Flagstaff on the morning of the 16th. A sharp fall also occurred in the remainder of the territory for which the warnings were issued, but it was not sufficient to amount to a cold wave, another LOW that produced a modifying effect having begun to develop over Nevada during the 16th.

Warnings of a moderate cold wave in southeastern Colorado were issued on the morning of the 28th, when the pressure at Denver and Pueblo had fallen to 29.24 inches. From the temperatures reported from extreme western Kansas, the warning appears to have been verified over a portion of southeastern Colorado, although the fall at Pueblo amounted to but 14° during the following 24 hours, with a minimum of 36° reported from that station on the morning of the 29th.

A cold wave without warning occurred at Santa Fe and Durango on the morning of the 9th, although, as already stated, livestock warnings had been issued for southwestern Colorado and northwestern New Mexico. A local cold wave, without warning, also occurred at Pueblo on the morning of the 17th.

The following frost warnings were issued: 5th, 6th, 28th, and 29th, southern New Mexico; 8th, south central and southwestern New Mexico and southern and western Arizona; 9th, southwestern Arizona; 11th, south central and southwestern New Mexico; 12th, south central and southwestern New Mexico and southern Arizona; 15th, 16th and 22d, southern Arizona; 19th, south central and southwestern Arizona; 23d, southeastern New Mexico; 30th southern New Mexico and south central and southwestern Arizona.

Freezing temperature warnings were issued as follows: 5th, 8th and 17th, extreme southeastern New Mexico; 9th and 19th, southern New Mexico and southeastern Arizona; 13th, 16th and 22d, southern New Mexico; 30th, extreme southeastern New Mexico and extreme southeastern Arizona; 31st southern New Mexico.

As a rule, the conditions forecast were verified by temperatures favorable for the formation of frost, or by the occurrence of frost or freezing weather.—*J. M. Sherier.*

SAN FRANCISCO FORECAST DISTRICT

The pressure movements over this district during March, 1924, were of the type usually associated with early spring. The storms which entered the continent south of the international boundry, were of small area and rapid movement and developed greatly in energy after passing inland, while the large storms from the